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OBJECTIVE

Performing Large-scale simulations with Computational Fluid Dynamics (CFD) code and visualizing the results on the TeraGrid resources.

INTRODUCTION

Large-Scale simulations and visualization of the results require computational power and powerful visualization systems.

In this study, we conducted performance evaluation of our parallel CFD code for large-scale simulations on the different TeraGrid machines. We also performed remote visualization on the TeraGrid for the results of these simulations.

APPLICATION CODES

PACER3D

A CFD flow solver code for simulations (IUPUI/ME).

GD

General Divider is an unstructured grid partitioner software (IUPUI/ME).

PARAVIEW

An open source multi-platform visualization software (www.paraview.org).

TERAGRID RESOURCES

NCSA's SGI ALTIX machine is used to partitioning the domain.

The simulations are carried on the NCSA's IA-64 TeraGrid Linux cluster and PSC's Compaq Alfaserver ES45 cluster.

Visualization is carried on the UC/ANL's IA-32 TeraGrid Linux Cluster.

TEST CASE AND RESULTS

To test the performance of the parallel solver flow around the aircraft configuration is considered. This geometry contains 18 million tetrahedral elements and more than 3 million nodal points. The geometry is partitioned into 64, 128, 256, 512 and 1024 solution blocks. Simulation is performed on the 64-1024 processors at each site.

PARALLEL VISUALIZATION

The results of the 512 blocks simulation case were selected for visualization. While 64 ParaView servers run on the UC/ANL cluster in parallel, the ParaView client runs on the local desktop machine. Each processor reads and renders 8 data sets out of 512. Once all the results are rendered, these images composited to form a final image and this image sent to the client. The final image is displayed on the local desktop machine.

CONCLUSIONS

We were able to demonstrate that is possible to run large-scale problems on the TeraGrid using up to 1024 processors rather routinely with reasonable speed-ups. Distributed and parallel capabilities of the ParaView is made possible to visualize large data sets.

